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(54) Replaceable ink container having a seperately attachable latch

(57) The present disclosure relates to a replaceable ink container 12 for providing ink to an inkjet printing system 10. The inkjet printing system 10 has a receiving station 14 for receiving the replaceable ink container 12. The replaceable ink container 12 includes an ink container chassis 34 for containing a quantity of ink. Also included is a latch 30 separate from the ink container chassis 34 that is attachable to the chassis 34 for securing the replaceable ink container 12 to the receiving station 14.

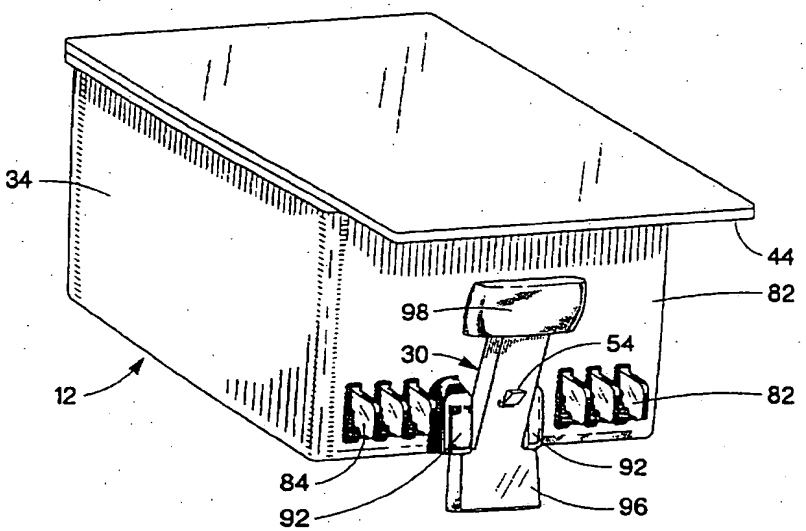

Fig. 14

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to ink containers for providing ink to inkjet printers. More specifically, the present invention relates to ink containers configured for insertion and removal from a receiving station within an inkjet printer.

[0002] Inkjet printers frequently make use of an inkjet printhead mounted within a carriage that is moved relative to a print media, such as paper. As the printhead is moved relative to the print media, a control system activates the printhead to deposit or eject ink droplets onto the print media to form images and text. Ink is provided to the printhead by a supply of ink that is either integral with the printhead, as in the case of a disposable print cartridge, or by a supply of ink that is replaceable separate from the printhead.

[0003] One type of previously used printing system makes use of the ink supply that is carried with the carriage. This ink supply has been formed integral with the printhead, whereupon the entire printhead and ink supply are replaced when ink is exhausted. Alternatively, the ink supply can be carried with the carriage and be separately replaceable from the printhead. For the case where the ink supply is separately replaceable, the ink supply is replaced when exhausted. The printhead is then replaced at the end of printhead life. Regardless of where the ink supply is located within the printing system, it is critical that the ink supply provides a reliable supply of ink to the inkjet printhead.

[0004] There is an ever present need for inkjet printing systems that make use of replaceable ink containers that are easy to install and remove. The installation of the ink container should produce reliable fluidic connection to the printer. These ink containers should be relatively easy to manufacture, thereby tending to reduce the ink supply cost. Reduction of the ink supply cost tends to reduce the per page printing costs of the printing system. In addition, these ink containers should be compact and configured to be inserted into the inkjet printing system to maintain a relatively small overall height of the printing system allowing a low profile printing system.

SUMMARY OF THE INVENTION

[0005] One aspect of the present invention is a replaceable ink container for providing ink to an inkjet printing system. The inkjet printing system has a receiving station for receiving the replaceable ink container. The replaceable ink container includes an ink container chassis for containing a quantity of ink. Also included is a latch separate from the ink container chassis that is attachable to the chassis for securing the replaceable ink container to the receiving station.

[0006] Another aspect of the present invention is where the receiving station includes a receiving station engagement feature. The latch further includes a complementary latch engagement feature wherein insertion of the replaceable ink container into the receiving station engages the receiving station engagement feature with the complementary latch engagement feature to secure the replaceable ink container to the receiving station.

[0007] Yet another aspect of the present invention is where the receptacle further includes a receptacle engagement feature. The latch is configured to further include a complementary a latch engagement feature wherein the insertion on the latch into the receptacle engages the receptacle engagement feature with the latch engagement feature to secure the latch to the ink container chassis.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Fig. 1 is one exemplary embodiment of an ink jet printing system of the present invention shown with a cover opened to show a plurality of replaceable ink containers of the present invention.

[0009] Fig. 2 is a greatly enlarged perspective view of a portion of a scanning carriage showing the replaceable ink containers of the present invention positioned in a receiving station that provides fluid communication between the replaceable ink containers and one or more printhead.

[0010] Fig. 3 is a side plan view of a portion of the scanning carriage showing guiding and latching features associated with each of the replaceable ink container and the receiving station for securing the replaceable ink container, thereby allowing fluid communication with the printhead.

[0011] Fig. 4 is a receiving station shown in isolation for receiving one or more replaceable ink containers of the present invention.

[0012] Figs. 5a, 5b, 5c, and 5d are isometric views of a three-color replaceable ink container of the present invention shown in isolation.

[0013] Fig. 6 is a perspective view of a single color replaceable ink container of the present invention.

[0014] Fig. 7a, 7b, and 7c depict the method of the present invention for inserting the replaceable ink container into the supply station.

[0015] Fig. 8a and 8b depict the passage of the replaceable ink container over an upstanding fluid inlet on the receiving station viewed from a side view and an end view, respectively.

[0016] Figs. 9a, 9b, and 9c depict a method of the present invention for removing the replaceable ink container from the receiving station.

[0017] Fig. 10 is a perspective view of a trailing end of the replaceable ink container of the present invention having a separable latch portion for securing the replaceable ink container to the receiving station.

[0018] Fig. 11 is a greatly enlarged perspective view of the trailing end of the replaceable ink container having

a separable latch portion as shown in Fig. 10 with the latch portion shown removed.

[0019] Fig. 12 is a greatly enlarged perspective view of the latch portion of Fig. 10 shown in isolation.

[0020] Fig. 13 is a greatly enlarged bottom view of the replaceable ink container showing a receptacle for receiving the separate latch portion shown in Fig. 12.

[0021] Fig. 14 is a perspective view of the trailing end of the replaceable ink container shown with the separate latch portion partially inserted into the receptacle.

[0022] Fig. 15 is a cross sectional view of the replaceable ink container shown secured to the receiving station by a separable latch that is secured to the replaceable ink container.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0023] Fig. 1 is a perspective view of one exemplary embodiment of a printing system 10 shown with its cover open, that includes at least one replaceable ink container 12 that is installed in a receiving station 14. With the replaceable ink container 12 properly installed into the receiving portion 14, ink is provided from the replaceable ink container 12 to at least one inkjet printhead 16. The inkjet printhead 16 is responsive to activation signals from a printer portion 18 to deposit ink on print media. As ink is ejected from the printhead 16, the printhead 16 is replenished with ink from the ink container 12. In one preferred embodiment the replaceable ink container 12, receiving station 14, and inkjet printhead 16 are each part of a scanning carriage that is moved relative to a print media 22 to accomplish printing. The printer portion 18 includes a media tray for receiving the print media 22. As the print media 22 is stepped through a print zone, the scanning carriage 20 moves the printhead 16 relative to the print media 22. The printer portion 18 selectively activates the printhead 16 to deposit ink on print media 22 to thereby accomplish printing.

[0024] The scanning carriage 20 is moved through the print zone on a scanning mechanism which includes a slide rod 26 on which the scanning carriage 20 slides as the scanning carriage 20 moves through a scan axis. A positioning means (not shown) is used for precisely positioning the scanning carriage 20. In addition, a paper advance mechanism (not shown) is used to step the print media 22 through the print zone as the scanning carriage 20 is moved along the scan axis. Electrical signals are provided to the scanning carriage 20 for selectively activating the printhead 16 by means of an electrical link such as a ribbon cable 28.

[0025] An important aspect of the present invention is the method and apparatus for securing the ink container 12 to the receiving station 14 such that the ink container 12 forms proper fluidic and electrical interconnect with the printer portion 18. In the preferred embodiment the latch mechanism is separately attached to the ink container to provide an easily manufacturable ink container 12 having a latch feature. It is essential the ink container 12 is secured to the receiving station such that both proper fluidic and electrical connection be established between the ink container 12 and the printer portion 18. The fluidic interconnection allows a supply of ink within the replaceable ink container 12 to be fluidically coupled to the printhead 16 for providing a source of ink to the printhead 16. The electrical interconnection allows information to be passed between the replaceable ink container 12 and the printer portion 18. Information passed between the replaceable ink container 12 and the printer portion 18 can include information related to the compatibility of replaceable ink container with printer portion 18 and operation status information such as ink level information, to name a few.

[0026] Before discussing the specific detail of the method and apparatus of the present invention for forming the ink container having a separate latch portion, as will be discussed with respect to Figures 10 through 14, it will be helpful to first discuss the general function of the ink container 12 and receiving station 14, as will be discussed with respect to Figs. 2 through 9. These general functional features depict those features which allow the replaceable ink container 12 to be inserted into the receiving station 14 in such a manner that reliable electrical and fluidic connection is established between the replaceable ink container 12 and the receiving station 14.

[0027] Fig. 2 is a perspective view of a portion of the scanning carriage 20 showing a pair of replaceable ink containers 12 properly installed in the receiving station 14. An inkjet printhead 16 is in fluid communication with the receiving station 14. In the preferred embodiment, the inkjet printing system 10 shown in Fig. 1 includes a tri-color ink container containing three separate ink colors and a second ink container containing a single ink color. In this preferred embodiment, the tri-color ink container contains cyan, magenta, and yellow inks, and the single color ink container contains black ink for accomplishing four-color printing. The replaceable ink containers 12 can be partitioned differently to contain fewer than three ink colors or more than three ink colors if more are required. For example, in the case of high fidelity printing, frequently six or more colors are used to accomplish printing.

[0028] The scanning carriage portion 20 shown in Fig. 2 is shown fluidically coupled to a single printhead 16 for simplicity. In the preferred embodiment, four inkjet printheads 16 are each fluidically coupled to the receiving station 14. In this preferred embodiment, each of the four printheads are fluidically coupled to each of the four colored inks contained in the replaceable ink containers. Thus, the cyan, magenta, yellow and black printheads 16 are each coupled to their corresponding cyan, magenta, yellow and black ink supplies, respectively. Other configurations which make use of fewer printheads than four are also possible. For example, the printhead 16 can be configured to print more than one ink color by

properly partitioning the printhead 16 to allow a first ink color to be provided to a first group of ink nozzles and a second ink color to be provided to a second group of ink nozzles, with the second group of ink nozzles different from the first group. In this manner, a single printhead 16 can be used to print more than one ink color allowing fewer than four printheads 16 to accomplish four-color printing. The fluidic path between each of the replaceable ink containers 12 and the printhead 16 will be discussed in more detail with respect to Fig. 3.

[0029] Each of the replaceable ink containers 12 include a latch 30 for securing the replaceable ink container 12 to the receiving station 14. The latch 30 will be discussed in more detail with respect to Figs. 10 - 14. The receiving station 14 in the preferred embodiment includes a set of keys 32 that interact with corresponding keying features (not shown) on the replaceable ink container 12. The keying features on the replaceable ink container 12 interact with the keys 32 on the receiving station 14 to ensure that the replaceable ink container 12 is compatible with the receiving station 14.

[0030] Fig. 3 is a side plan view of the scanning carriage portion 20 shown in Fig. 2. The scanning carriage portion 20 includes the ink container 12 shown properly installed into the receiving station 14, thereby establishing fluid communication between the replaceable ink container 12 and the printhead 16.

[0031] The replaceable ink container 12 includes a reservoir portion 34 for containing one or more quantities of ink. In the preferred embodiment, the tri-color replaceable ink container 12 has three separate ink containment reservoirs, each containing ink of a different color. In this preferred embodiment, the monochrome replaceable ink container 12 is a single ink reservoir 34 for containing ink of a single color.

[0032] In the preferred embodiment, the reservoir 34 has a capillary storage member (not shown) disposed therein. The capillary storage member is a porous member having sufficient capillarity to retain ink to prevent ink leakage from the reservoir 34 during insertion and removal of the ink container 12 from the printing system 10. This capillary force must be sufficiently great to prevent ink leakage from the ink reservoir 34 over a wide variety of environmental conditions such as temperature and pressure changes. In addition, the capillarity of the capillary member is sufficient to retain ink within the ink reservoir 34 for all orientations of the ink reservoir as well as a reasonable amount of shock and vibration the ink container may experience during normal handling. The preferred capillary storage member is a network of heat bonded polymer fibers described in US Patent Application entitled "Ink Reservoir for an Inkjet Printer" attorney docket 10991407 filed on October 29, 1999, serial number 09/430,400, assigned to the assignee of the present invention and incorporated herein by reference.

[0033] Once the ink container 12 is properly installed into the receiving station 14, the ink container 12 is fluidically coupled to the printhead 16 by way of fluid interconnect 36. Upon activation of the printhead 16, ink is ejected from the ejection portion 38 producing a negative gauge pressure, sometimes referred to as backpressure, within the printhead 16. This negative gauge pressure within the printhead 16 is sufficient to overcome the capillary force, retaining within the capillary member disposed within the ink reservoir 34. Ink is drawn by this backpressure from the replaceable ink container 12 to the printhead 16. In this manner, the printhead 16 is replenished with ink provided by the replaceable ink container 12.

[0034] The fluid interconnect 36 is preferably an upstanding ink pipe that extends upwardly into the ink container 12 and downwardly to the inkjet printhead 16. The fluid interconnect 36 is shown greatly simplified in Fig. 3. In the preferred embodiment, the fluid interconnect 36 is a manifold that allows for offset in the positioning of the printheads 16 along the scan axis, thereby allowing the printhead 16 to be placed offset from the corresponding replaceable ink container 12. In the preferred embodiment, the fluid interconnect 36 extends into the reservoir 34 to compress the capillary member, thereby forming a region of increased capillarity adjacent the fluid interconnect 36. This region of increased capillarity tends to draw ink toward the fluid interconnect 36, thereby allowing ink to flow through the fluid interconnect 36 to the printhead 16. As will be discussed, it is crucial that the ink container 12 be properly positioned within the receiving station 14 such that proper compression of the capillary member is accomplished when the ink container 12 is inserted into the receiving station. Proper compression of the capillary member is necessary to establish a reliable flow of ink from the ink container 12 to the printhead 16.

[0035] The replaceable ink container 12 further includes a guide feature 40, an engagement feature 42, a handle 44 and a latch feature 30 that allow the ink container 12 to be inserted into the receiving station 14 to achieve reliable fluid interconnection with the printhead 16 as well as form reliable electrical interconnection between the replaceable ink container 12 and the scanning carriage 20 as will be discussed with respect to Figs. 7a-7c and 8a-8b.

[0036] The receiving station 14 includes a guide rail 46, an engagement feature 48 and a latch engagement feature 50. The guide rail 46 cooperates with the guide rail engagement feature 40 and the replaceable ink container 12 to guide the ink container 12 into the receiving station 14. Once the replaceable ink container 12 is fully inserted into the receiving station 14, the engagement feature 42 associated with the replaceable ink container engages the engagement feature 48 associated with the receiving station 14, securing a front end or a leading end of the replaceable ink container 12 to the receiving station 14. The ink container 12 is then pressed downward to compress a spring biasing member 52 associated with the receiving station 14 until a latch engagement feature 50 associated with the receiving station 14

engages a hook feature 54 associated with the latch member 30 to secure a back end or trailing end of the ink container 12 to the receiving station 14. It is the cooperation of the features on the ink container 12 with the features associated with the receiving station 14 that allow proper insertion and functional interfacing between the replaceable ink container 12 and the receiving station 14. The receiving station 14 will now be discussed in more detail with respect to Fig. 4.

[0037] Fig. 4 is a front perspective view of the ink receiving station 14 shown in isolation. The receiving station 14 shown in Fig. 4 includes a monochrome bay for receiving an ink container 12 containing a single ink color and a tri-color bay 58 for receiving an ink container having three separate ink colors contained therein. In this preferred embodiment, the monochrome bay 56 receives a replaceable ink container 12 containing black ink, and the tri-color bay receives a replaceable ink container containing cyan, magenta, and yellow inks, each partitioned into a separate reservoir within the ink container 12. The receiving station 14 as well as the replaceable ink container 12 can have other arrangements of bays 56 and 58 for receiving ink containers containing different numbers of distinct inks contained therein. In addition, the number of receiving bays 56 and 58 for the receiving station 14 can be fewer or greater than two. For example, a receiving station 14 can have four separate bays for receiving four separate monochrome ink containers 12 with each ink container containing a separate ink color to accomplish four-color printing.

[0038] Each bay 56 and 58 of the receiving station 14 includes an aperture for receiving the upright fluid interconnect 36 that extends therethrough. The fluid interconnect 36 is a fluid inlet for ink to exit a corresponding fluid outlet associated with the ink container 12. An electrical interconnect 62 is also included in each receiving bay 56 and 58. The electrical interconnect 62 includes a plurality of electrical contacts 64. In the preferred embodiment, the electrical contacts are an arrangement of four spring-loaded electrical contacts with proper installation of the replaceable ink container 12 into the corresponding bay of the receiving station 14. Proper engagement with each of the electrical connectors 62 and fluid interconnects 36 must be established in a reliable manner.

[0039] The guide rails 46 disposed on either side of the fluid interconnects within each bay 56 and 58 engage the corresponding guide feature 40 on either side of the ink container 12 to guide the ink container into the receiving station. When the ink container 12 is fully inserted into the receiving station 14, the engagement features 48 disposed on a back wall 66 of the receiving station 14 engage the corresponding engagement features 42 shown in Fig. 3 on the ink container 12. The engagement features 48 are disposed on either side of the electrical interconnect 62. A biasing means 52 such as a leaf spring is disposed within the receiving station 14. The leaf spring 52 provides a biasing force which tends to urge the ink container 12 upward from a bottom surface 68 of the receiving station 14. The leaf spring aids in the latching of the ink container 12 to the receiving station 14 as well as aiding the removal of the ink container 12 from the receiving station as will be discussed with respect to Figs. 8 and 9.

[0040] Figs. 5a, 5b, 5c, and 5d show front plan, side plan, back plan, and bottom plan views, respectively, of the replaceable ink container 12 of the present invention. As shown in Fig. 5a, the replaceable ink container 12 includes a pair of outwardly projecting guide rail engagement features 40. In the preferred embodiment, each of these guide rail engagement features extend outwardly in a direction orthogonal to upright side 70 of the replaceable ink container 12. The engagement features 42 extend outwardly from a front surface or leading edge of the ink container 72. The engagement features 42 are disposed on either side of an electrical interface 74 and are disposed toward a bottom surface 76 of the replaceable ink container 12. The electrical interface 74 includes a plurality of electrical contacts 78, with each of the electrical contacts 78 electrically connected to an electrical storage device 80.

[0041] Opposite the leading end 72 is a trailing end 82 shown in Fig. 5c. The trailing end 82 of the replaceable ink container 12 includes the latch feature 30 having an engagement hook 54. The latch feature 30 is formed of a resilient material which allows the latch feature to extend outwardly from the trailing end thereby extending the engagement feature outwardly toward the corresponding engagement feature associated with the receiving station 14. As will be discussed as the latch member 30 is compressed inwardly toward the trailing end 82, the latch member exerts a biasing force outwardly in order to ensure the engagement feature 54 remains in engagement with the corresponding engagement feature 50 associated with the receiving station 14 to secure the ink container 12 into the receiving station 14.

[0042] The replaceable ink container 12 also includes keys 84 disposed on the trailing end of the replaceable ink container 12. The keys are preferably disposed on either side of the latch 30 toward the bottom surface 76 of the replaceable ink container 12. The keys 84, together with keying features 32 on the receiving station 14, interact to ensure the ink container 12 is inserted in the correct bay 56 and 58 in the receiving station 14. In addition, the keys 84 and the keying features 32 ensure that the replaceable ink container 12 contains ink that is compatible both in color and in chemistry or computability with the corresponding receiving bay 56 and 58 within the receiving station 14.

[0043] Also included in the ink container 12 is the handle portion 44 disposed on a top surface 86 at the trailing edge 82 of the replaceable ink container 12. The handle 44 allows the ink container 12 to be grasped at the trailing edge 82 while inserted into the appropriate bay of

the receiving station 14.

[0044] Finally, the ink container 12 includes apertures 88 disposed on the bottom surface 76 of the replaceable ink container 12. The apertures 88 allow the fluid interconnect 36 to extend through the reservoir 34 to engage the capillary member disposed therein. In the case of the tri-color replaceable ink container 12, there are three fluid outlets 88, with each fluid outlet corresponding to a different ink color. In the case of the tri-color chamber, each of three fluid interconnects 36 extend into each of the fluid outlets 88 to provide fluid communication between each ink chamber and the corresponding print head for that ink color.

[0045] Fig. 6 is a perspective view of a monochrome ink container positioned for insertion into the monochrome bay 56 in the receiving station 14 shown in Fig. 4. The monochrome ink container shown in Fig. 6 is similar to the tri-color ink container shown in Figs. 5a through 5d except that only a single fluid outlet 88 is provided in the bottom surface 76. The monochrome replaceable ink container 12 contains a single ink color and therefore receives only a single corresponding fluid interconnect 36 for providing ink from the ink container 12 to the corresponding printhead.

[0046] Fig. 7a, 7b, and 7c is a sequence of figures to illustrate the technique of the present invention for inserting the replaceable ink container 12 into the receiving station 14 to form reliable electrical and fluidic connections with the receiving station 14.

[0047] Fig. 7a shows the ink container 12 partially inserted into the receiving station 14. In the preferred embodiment, the ink container 12 is inserted into the receiving station 14 by grasping the handle portion 44 and inserting the ink container into the receiving station with the leading edge or leading face 72 first. As the leading edge 72 enters the receiving station 14 the outwardly extending guide members 40 on the ink container engage each of the pair of guide rails 46. The guide rails 46 guide the ink container 12 in a horizontal or linear motion toward the back wall 66 of the receiving station 14. The guide rails 46 then guide the replaceable ink container in both a horizontal direction toward the back wall 66 and a vertical direction toward the bottom surface of the receiving station 14 such that the engagement feature 42 on the ink container 12 is received by a corresponding engagement feature 48 on the back wall 66 of the receiving station 14 as shown in Fig. 7b. The insertion of the ink container 12 requires only an insertion force to urge the ink container linearly along the guide rail 46. The gravitational force acting on the ink container 12 tends to cause the ink container to follow the guide rails 46 as the guide rails extend in a downward direction to allow engagement of engagement features 42 and 48. The guide rail engagement features 40 are preferably gently rounded surfaces to slide freely along the guide rails 46.

[0048] Fig. 7b shows the ink container 12 inserted into the receiving station 14 such that the engagement feature 42 is in engagement with the engagement feature 48 associated with the receiving station 14. A downward force is applied to the ink container 12 as represented by arrows 90 to. compress the leaf spring 52 and to urge the trailing end 82 of the ink container 12 downwardly toward the bottom surface 68 of the receiving station 14. The keys 84 must properly correspond to the keying feature 32 on the receiving station 14. If the keys 84 on the ink container 12 do not correspond to the keying features 32, the keying system will prevent further insertion of the ink container 12 into the receiving station 14. This keying system made up of keys 84 and the keying features 32 prevent ink containers that are not compatible with the receiving station 14 be prevented from further insertion into the receiving station 14. Further insertion of the ink container 12 into the receiving station 14 could result in contact of the fluid interconnect 36 with the capillary member within the ink container 12, thereby contaminating the fluid interconnect 36 with incompatible ink. Incompatible ink mixing in the fluid interconnect 36 can result in precipitation which can damage the printhead 16. In addition to inks of incompatible chemistries, the ink container can have an incompatible color which can result in color mixing. thereby reducing the output print quality.

[0049] The keys 84 on the ink container 12 and the keying features 32 on the receiving station 14 allow for the complete insertion of the proper ink container 12 into the proper receiving station 14. The downward force applied to the trailing end 82 of the ink container 12 causes the ink container 12 to pivot about a pivot axis compressing the leaf spring 52, thereby moving the trailing edge 82 of the ink container 12 toward the bottom surface 68 of the receiving station 14. As the ink container 12 is urged downward into the receiving station 14, the resilient latch 30 is compressed slightly inward toward the trailing edge 82 of the ink container 12. Once the ink container 12 is urged downward sufficiently far, the engagement feature 54 on the latch 30 engages with a corresponding engagement feature 50 on the receiving station 14 to secure the ink container 12 to the receiving station 14 as shown in Fig. 7c.

[0050] With the ink container 12 properly secured in the receiving station 14 as shown in Fig. 7c the fluid interconnect 36 extends into the reservoir 34 to compress the capillary member, thereby forming a region of increased capillarity adjacent the fluid interconnect 36. This region of increased capillarity tends to draw ink toward the fluid interconnect 36, thereby allowing ink to flow through the fluid interconnect 36 to the printhead 16. In the preferred embodiment, the ink container 12 when inserted into the receiving station 14 is oriented in a gravitational frame of reference so that a gravitational force acts on ink within the ink container 12 tending to draw ink toward the bottom surface 76 of the ink container 12. Thus ink within the ink container 12 is drawn to the bottom surface 76 where this ink is drawn toward the fluid interconnect 36 by capillary attraction thereby

tending to reduce or minimize stranding of ink within the ink container 12.

[0051] Figs 8a and 8b illustrate a position in the insertion process described with respect to Figs. 7a, 7b and 7c wherein the leading edge 72 of the ink container 12 is positioned over the fluid interconnect 36. Fig. 8a depicts a side view with Fig. 8b showing an end view. It can be seen from Figs. 8a and 8b that the guide feature 40 must be positioned on the ink container 12 low enough toward the bottom surface 76 of the ink container 12 such that the leading edge 72 of the ink container does not collide the fluid interconnect 36 during insertion. Another constraint on the positioning of the guide member 40 is that the guide member 40 must be positioned sufficiently close to the top surface 86 of the ink container 12 to insure that the engagement feature 42 properly engages with the corresponding engagement feature 42 on the receiving station 14.

[0052] In addition, the outwardly extending guide members 40 on the ink container must extend outward sufficiently far to engage the guide rails 46. However, the outwardly extending guide members 40 should not extend too far outward such that the guide members 40 engage the upright sides in the receiving station 14, producing interference which produces friction and binding which resists insertion of the ink container 12 into the receiving station 14.

[0053] Figs. 9a, 9b, and 9c illustrate the technique for removing the ink container 12 from the receiving station 14. The technique for removing the ink container 12 begins with the release of the engagement feature from the corresponding engagement feature 50 on the receiving station 14 by urging the latch 30 toward the trailing surface 82. Once the trailing edge of the ink container 12 is released, the spring 52 urges the trailing edge of the ink container upward as shown in Fig. 9b. The ink container 12 can be grasped by handle 44 to retrieve the ink container 12 in a direction opposite the insertion direction. As the ink container 12 is withdrawn from the receiving station 14, the guide member 40 follows the guide rails 46 to lift the ink container, thereby preventing interference between the fluid interconnect 36 and the fluid outlet on the bottom surface of the ink container 12.

[0054] Fig. 10 is a perspective view of the trailing end 82 of the replaceable ink container 12 showing one preferred embodiment of the latch portion 30 that is separable from the replaceable ink container 12. The use of a separate latch portion 30 that is attached to the replaceable ink container 12 has several advantages over the use of a ink container 12 having the latch portion molded integrally with the ink container. Some of these advantages of the two-piece ink container 12 of the present invention includes the ability to separately optimize materials for forming the ink container and the materials for forming the latch portion 30. For example, the ink containment reservoir 34 should be formed of a material that provides excellent vapor barrier properties for preventing the diffusion of air through the reservoir 34. The diffusion of air into the reservoir 34 can result in various problems that affect the reliability of the printing system. Air diffusion into the reservoir 34, if sufficient, causes problems such as air accumulation in the printhead as well as occlusion of fluid conduits, each of which can affect reliability as well as print quality. In contrast, the latch feature 30 should be formed from a material which exhibits proper resiliency characteristics for the latch operation. In addition, the latch portion 30 should be formed of a material which is well-suited for forming the latch features. The use of a two piece reservoir 34 and latch portion 30 allows for the optimization of each of these characteristics. Thus, the reservoir 34 is formed of a first material, and the latch portion 30 is formed of a second material different from the first material.

[0055] A second benefit to the technique of the present invention for forming the latch portion 30 separately from the reservoir portion 34 removes a constraint on the mold required for forming the reservoir 34. In the case where the latch portion 30 is integral with the reservoir 34 such as a living hinge that is formed between the latch 30 and the reservoir 34 requires special constraints on the mold design. By allowing the reservoir 34 to be formed separately from the latch 30 frees a constraint on the mold, thereby allowing other features to be formed in the reservoir 34 such as a lip or flange around the top of the ink container for attaching a lid portion. In this case, it would be difficult, if not impossible, to design a mold to form both an integral latch 30 in addition to a lip portion or flange for attaching the lid portion of the ink container 12.

[0056] A third benefit to the technique of the present invention for forming the latch portion 30 separately from the reservoir portion 34 is to allow the use of different color resins for latch portion 30 and reservoir portion 34. A different color for the latch portion 30 can be indicative of a user-configured or user-displaced portion of the ink container 12. In one embodiment, the reservoir portion 34 is molded from black plastic, and the latch portion 30 is molded from gray or green plastic to indicate to the user that the latch portion 30 needs to be displaced or bent by the user in order to remove ink container 12 from printer portion 18.

[0057] In the preferred embodiment, the reservoir 34 of the ink container 12 includes a receptacle 92 for receiving the latch portion 30. The receptacle 92 is positioned between the keying features 84 toward a bottom portion of the trailing edge 82.

[0058] Fig. 11 shows a greatly enlarged view of the bottom portion of the trailing edge shown broken away with the latch portion 30 removed. The receptacle 92 is configured to receive the latch portion 30 and secure the latch portion 30 to the reservoir or chassis 34. The receptacle 92 forms a pocket for receiving the latch portion 30. An engagement portion 94 is formed on the reservoir 34 to engage the latch portion 30 preventing or resisting removal of the latch 30 from the receptacle 92.

[0059] Fig. 12 shows the latch portion 30 greatly en-

larged and in isolation. The latch portion 30 includes a mounting portion 96 and a handle portion 98 opposite the mounting portion 96. The engagement feature 54 is disposed between the mounting portion 96 and the handle portion 98 for engaging the corresponding engagement feature 50 associated with the receiving station as discussed previously. In the preferred embodiment, the mounting portion 96 has a pair of sides 100 that are tapered from a bottom end 102 toward a top end 104. In addition, the pair of sides 100 are also tapered in a second direction from a back side 106 toward a front side 108. The tapering on the pair of sides 100 is configured to correspond to complementary tapers on the receptacle 92 as will be discussed with respect to Fig. 13.

[0060] Fig. 13 shows a bottom view of the trailing edge of the ink reservoir 34 showing the receptacle 92 for receiving the latch portion 30. The receptacle 92 includes a pair of slots 110 that are configured to receiving the mounting portion 96 of the latch feature 30. The pair of tapered sides 100 on the mounting portion 96 has a complementary taper to the taper on the tapered sides 110.

[0061] Fig. 14 shows the method of the present invention for inserting the handle portion 30 into the receptacle 92 such that the mounting portion 96 is secured to the ink reservoir or chassis 34. The mounting portion 96 is inserted into the receptacle 92 from the bottom of the ink container 12 and inserted upward in a direction parallel to the surface of the trailing end 82.

[0062] Fig. 15 shows the ink container 12 properly secured to the receiving station 14. The ink container 12 is secured to the receiving station by the latch 30. The latch 30 is secured on one end to the ink container 12 by the receptacle 92 that secures the latch 30 to the trailing end 82 of the ink container. The engagement portion 94 engages a complementary engagement portion 112 on the latch portion 30 for securing the latch portion once the latch portion is fully inserted into the receptacle 92. The latch portion 30 includes the engagement portion 54 that engages a corresponding engagement portion 50 on the receiving station 14 for securing the replaceable ink container 12 to the receiving station 14.

[0063] The latch portion 30 is formed so that the mounting portion 96 is positioned against the trailing surface 82 while the handle portion 98 is spaced from the trailing surface 82 so that the engagement portion 54 engages the corresponding engagement portion 50. It is important that the latch portion 30 be formed of a material which is resilient that allows the latch portion 30 to resiliently bend toward the trailing edge 82 during insertion and to spring away from the trailing edge 82 to engage the corresponding latch feature 50 in the receiving station 14. Similarly, the latch 30 must also be sufficiently resilient so that when a force is placed on the handle portion 98 to urge the handle portion toward the trailing edge 82, the engagement portion 54 becomes disengaged from the corresponding engagement portion 50 to release the ink container 12 from the receiving station 14.

[0064] The method and apparatus of the present invention allows the latch portion to be formed separately from the ink reservoir portion 34 to optimize material properties of each of the ink reservoir 34 and the latch 30. In addition, forming the latch portion 30 separately from the reservoir portion 34, allows the replaceable ink container 12 to be formed either in a simpler molding process than if the latch were formed integral with the reservoir 34, thereby either reducing the cost of the replaceable ink container or allowing other features to be molded into the replaceable ink reservoir 34 that could be formed if the latch were to be formed integral with the replaceable ink container 12.

Claims

1. A replaceable ink container 12 for providing ink to an inkjet printing system 10, the inkjet printing system 10 having a receiving station 14 for receiving the replaceable ink container 12, the replaceable ink container 12 comprising:

   an ink container chassis 34 for containing a quantity of ink; and
   a latch 30 separate from the ink container chassis 34 that is attachable to the chassis 34 for securing the replaceable ink container 12 to the receiving station 14.

2. The replaceable ink container 12 of claim 1 wherein the latch 30 has a mounting portion 96 and a handle portion 98 opposite the mounting portion 96 and wherein the latch 30 and chassis 34 are configured with the mounting portion 96 engaging the chassis 34 to resiliently bias the handle portion 98 away from the chassis 34 so that the handle portion 98 can be urged toward the chassis 34 to release the replaceable ink container 12 from the receiving station 14.

3. A replaceable ink container 12 for providing ink to an inkjet printing system 10, the inkjet printing system 10 having a receiving station 14 for receiving the replaceable ink container 12, the replaceable ink container 12 including:

   a reservoir 34 for containing a quantity of ink, the reservoir 34 having an outer surface that defines a receptacle 92; and
   a latch 30 for securing the ink container 12 to the receiving station 14, the latch 30 configured to be received within the receptacle 92 to secure the latch 30 to the reservoir 34.

4. The replaceable ink container 12 of claim 3 wherein the receptacle 92 is a raised feature on the outer

surface having a pair of slots 110 defined therein and configured to receive with the latch 30 as the latch 30 is inserted parallel to the outer surface.

5. The replaceable ink container 12 of claim 3 wherein the latch 30 has a mounting portion 96 and a handle portion 98 opposite the mounting portion 96 and wherein the outer surface of the reservoir 34 has an outwardly extending engagement feature 94 that is configured to engage a complementary shaped recess 112 in the latch 30 to secure the latch to the reservoir 34.

6. The replaceable ink container 12 of claim 3 wherein the receiving station 14 includes a receiving station engagement feature 50 and the latch 30 further includes a complementary latch engagement feature 54 wherein insertion of the replaceable ink container 12 into the receiving station 14 engages the receiving station engagement feature 50 with the complementary latch engagement feature 54 to secure the replaceable ink container 12 to the receiving station 14.

7. The replaceable ink container 12 of claim 3 wherein the reservoir 34 and the latch 30 are configured to form a living hinge when the latch 30 is properly received within the receptacle 92.

8. A method for assembling a replaceable ink container 12 comprising: providing a replaceable ink container 12 and a separate latch portion 30; and inserting the latch portion 30 into a receptacle 92 on the replaceable ink container 12.

9. The method for assembling a replaceable ink container 12 of claim 8 further including filling the replaceable ink container 12 with ink.

10. The method for assembling a replaceable ink container 12 of claim 8 wherein before the providing a replaceable ink container 12 and a separate latch portion 30 the method further including forming the replaceable ink container 12 to have a receptacle 92 therein, the receptacle 92 configured to receive the latch portion 30.

11. A replaceable ink container 12 for providing ink to an inkjet printing system 10, the inkjet printing system 10 having a receiving station 14 for receiving the replaceable ink container 10, the replaceable ink container 10 comprising:

an ink container reservoir 34 formed of a first material selected to have characteristics for containing a quantity of ink; and
a latch 30 attachable to the reservoir 34 and formed of a second material selected to have characteristics for securing the replaceable ink container 12 to the receiving station 14.

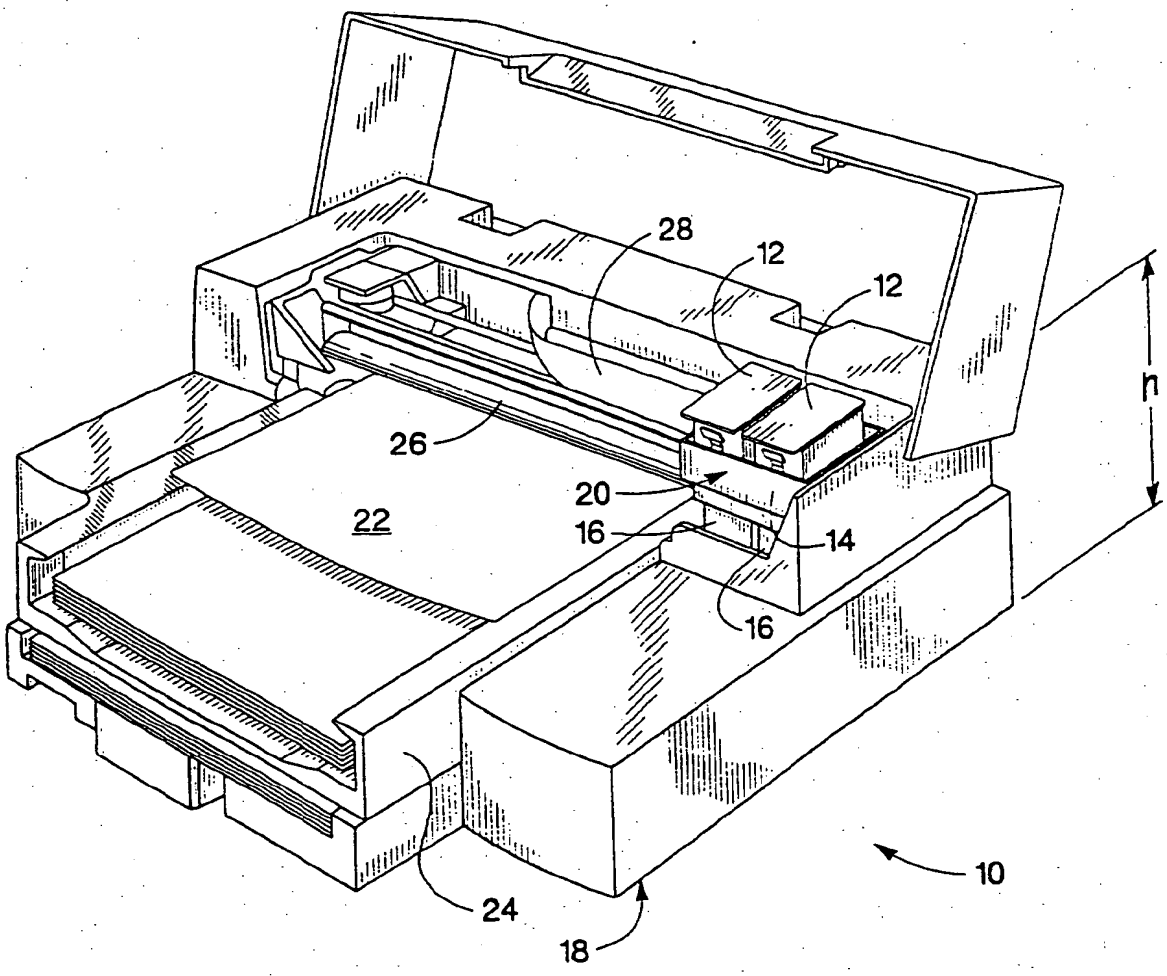

Fig. 1

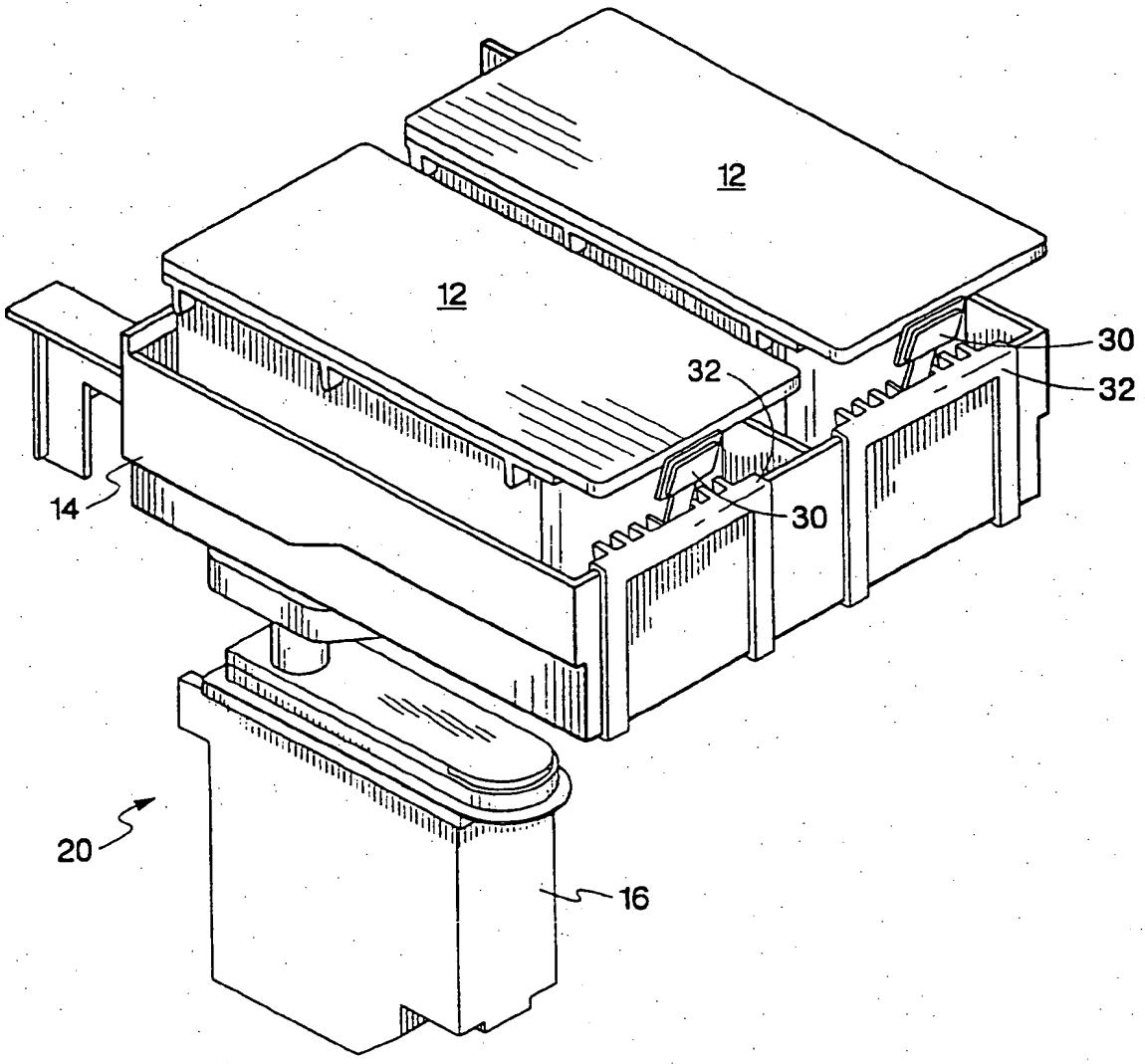

Fig. 2

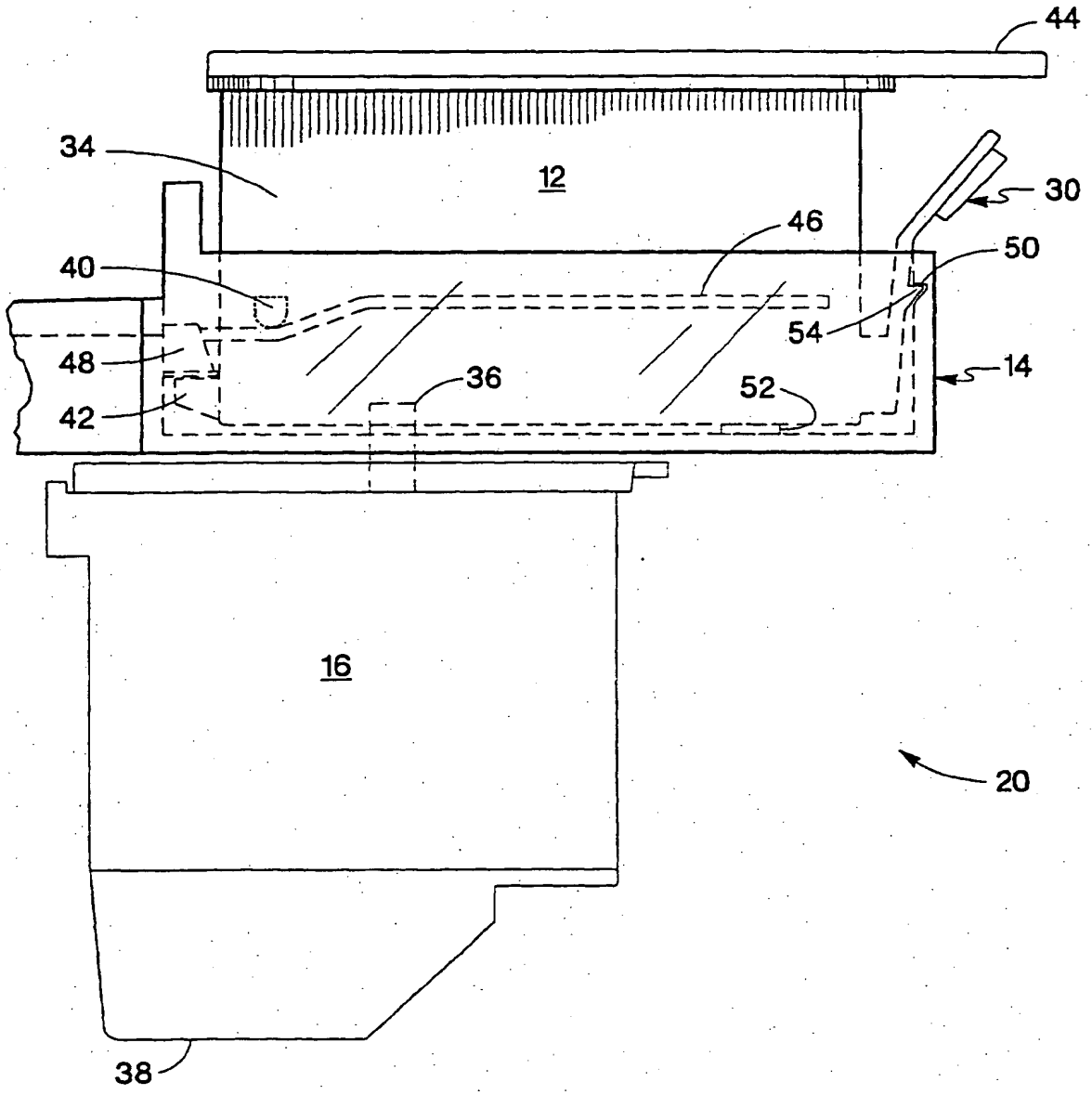

Fig. 3

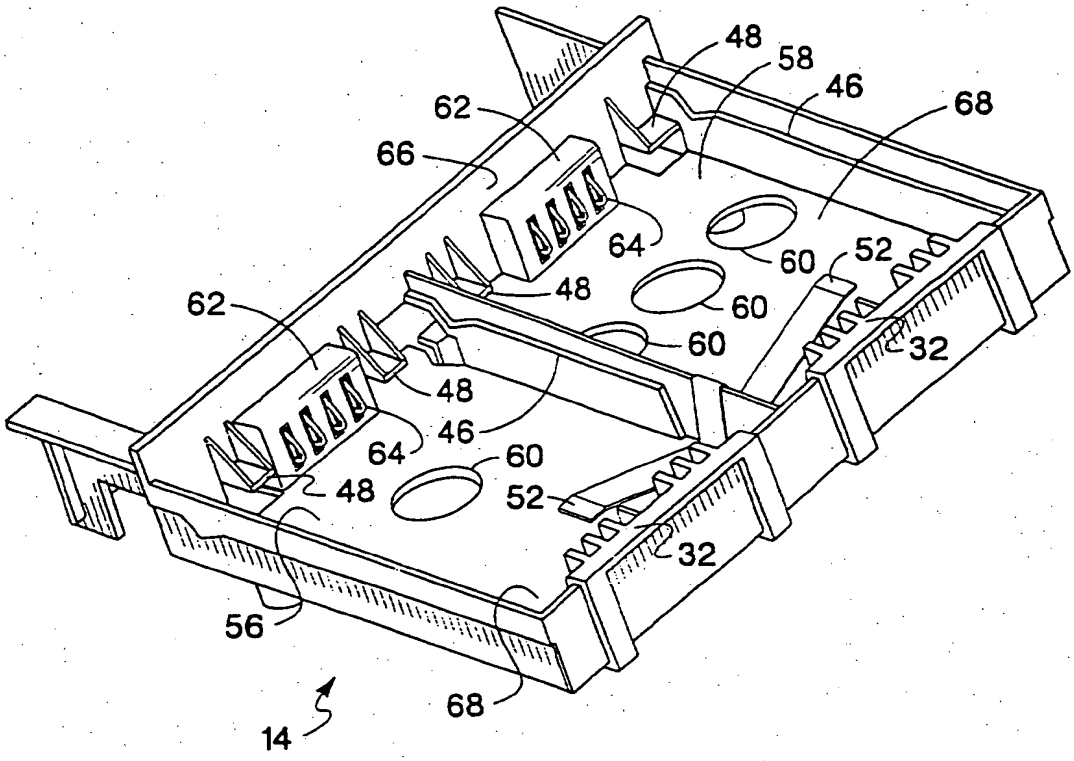

Fig. 4

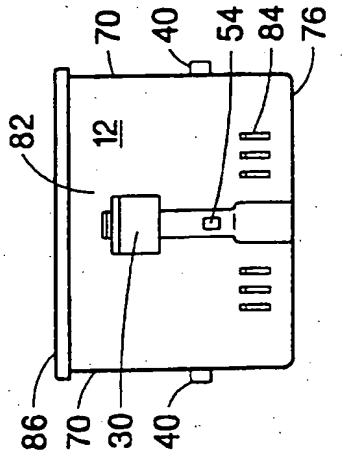

Fig. 5c

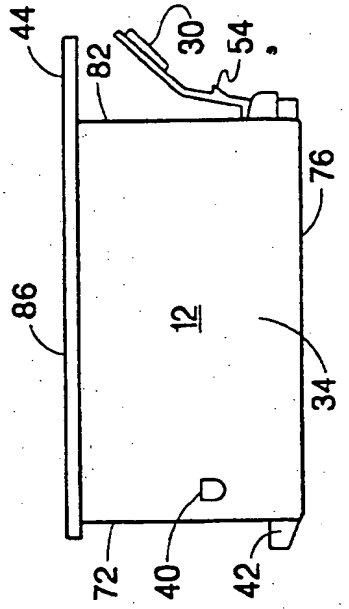

Fig. 5b

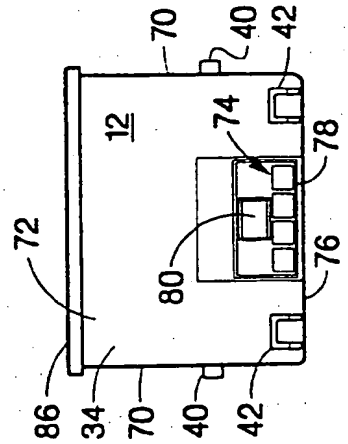

Fig. 5a

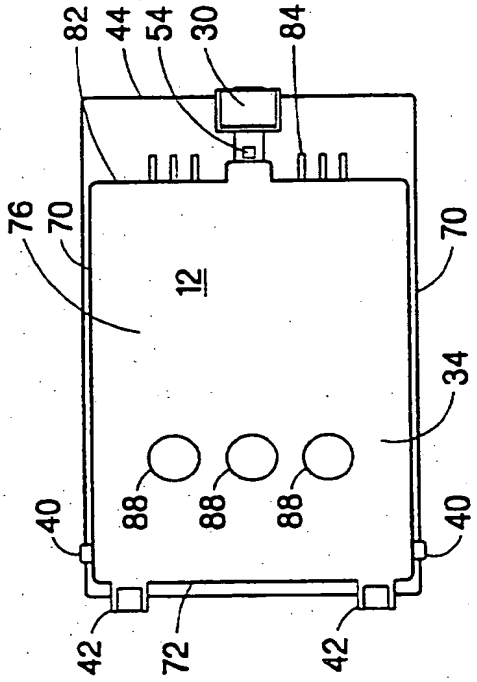

Fig. 5d

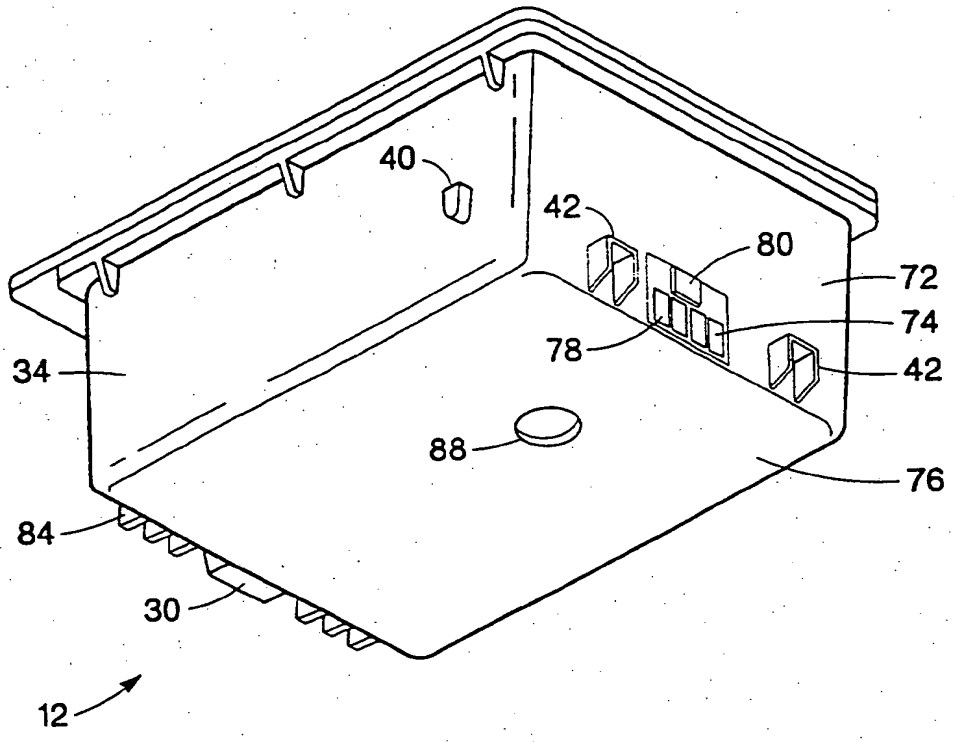

Fig. 6

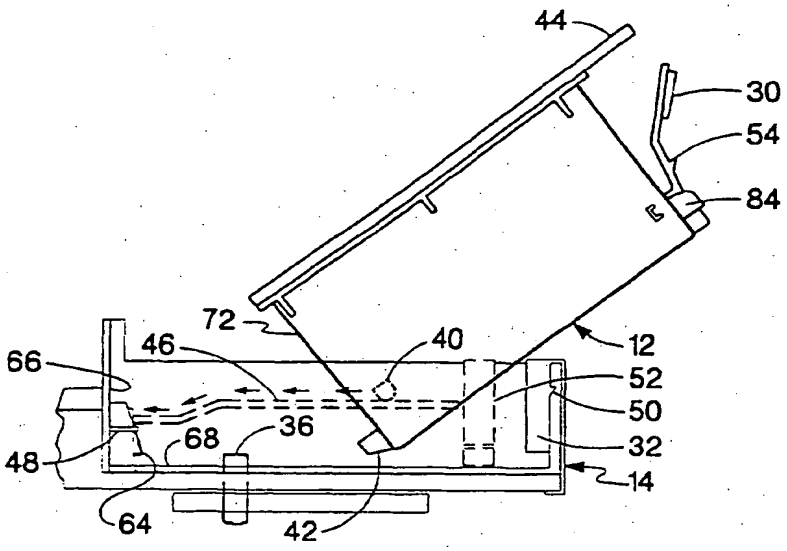

Fig. 7a

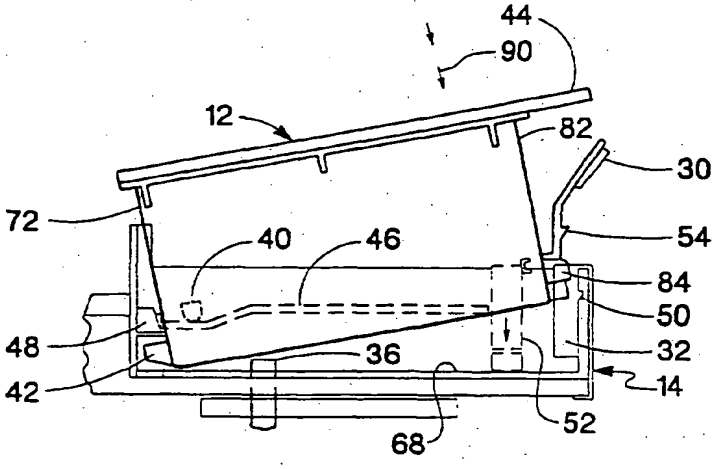

Fig. 7b

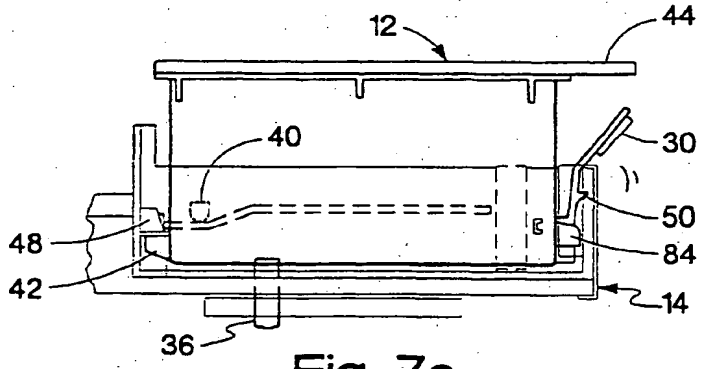

Fig. 7c

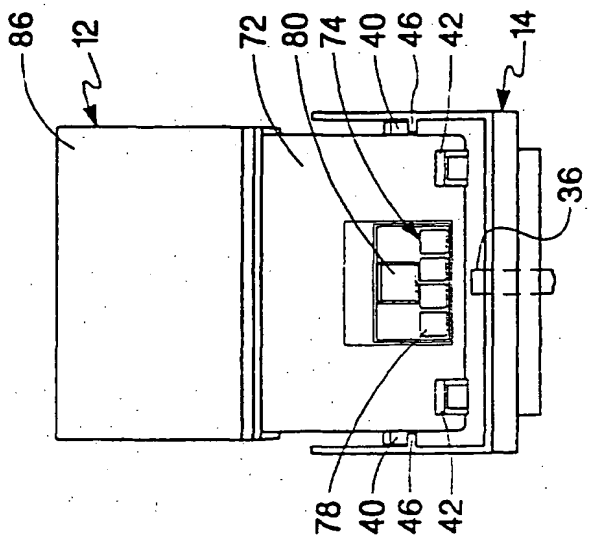
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Fig. 8b

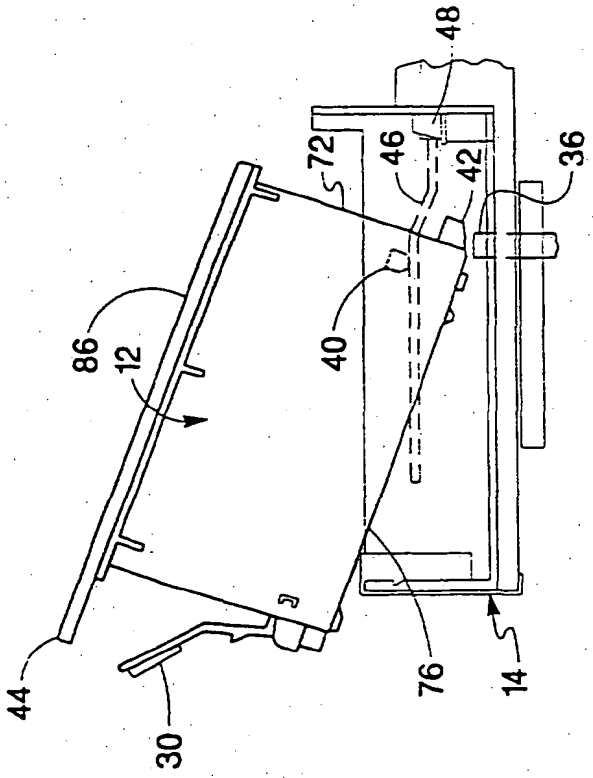
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Fig. 8a

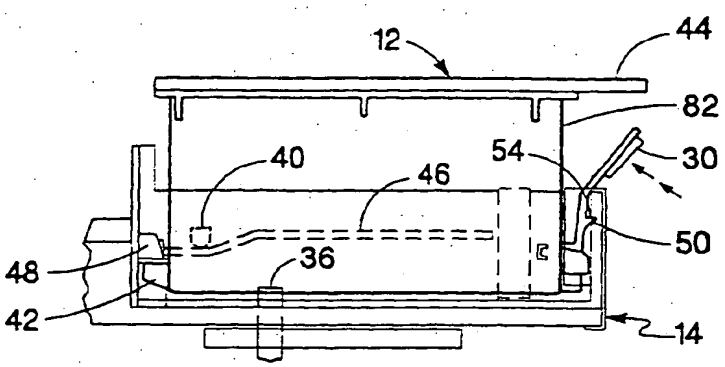

Fig. 9a

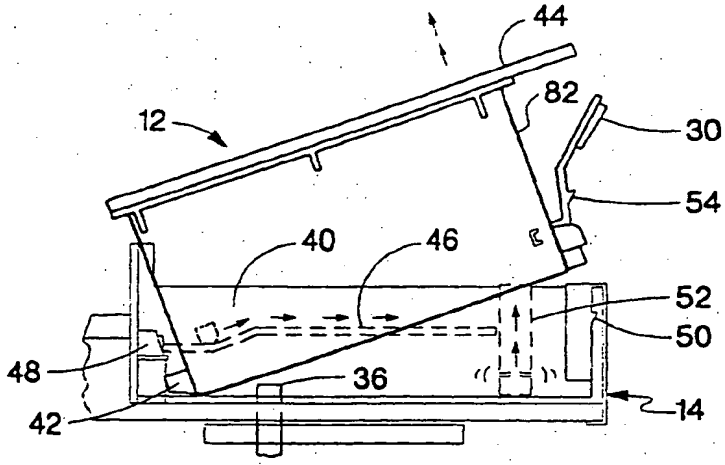

Fig. 9b

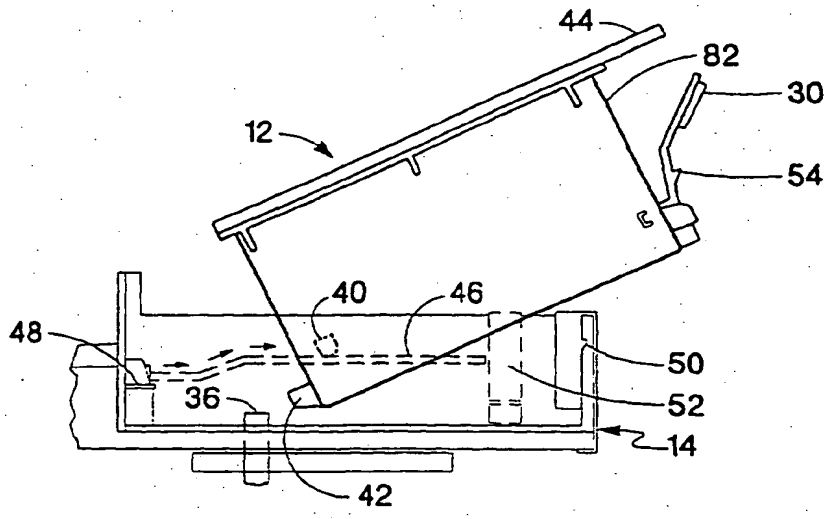

Fig. 9c

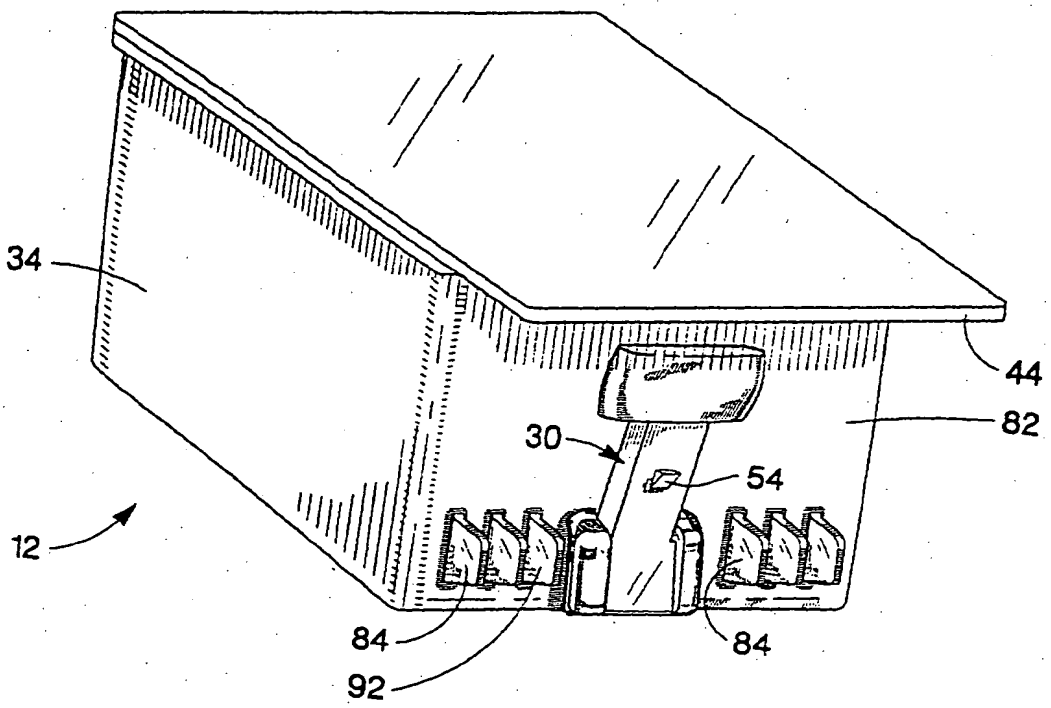

Fig. 10

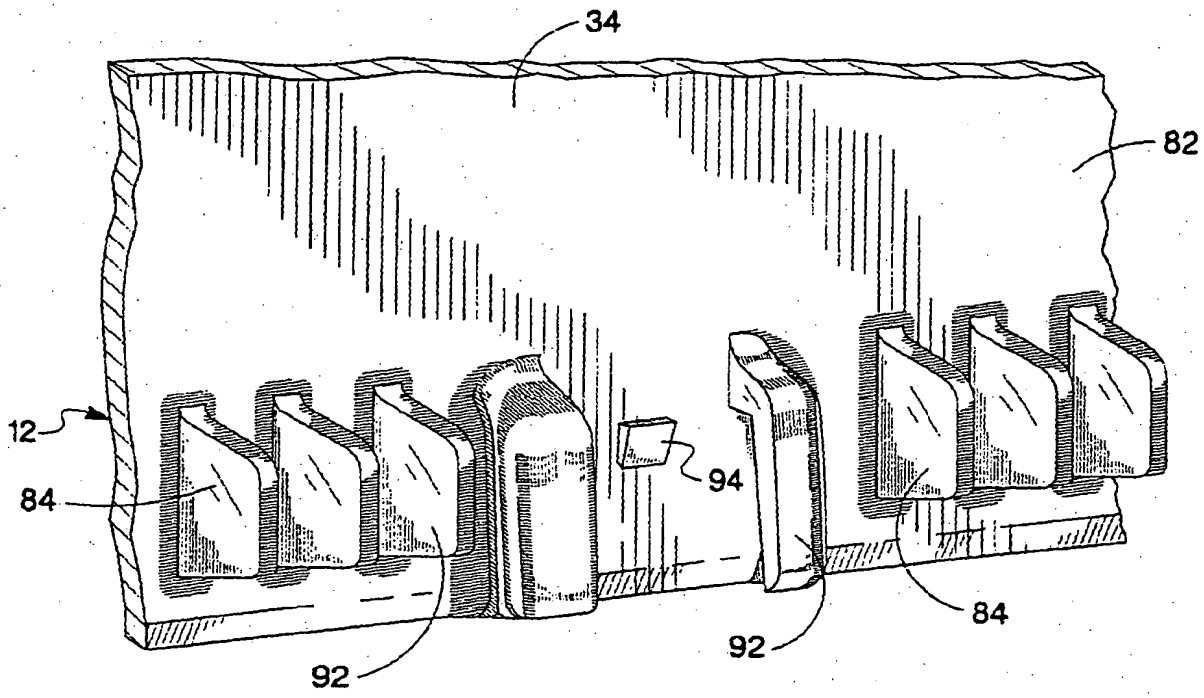

Fig. 11

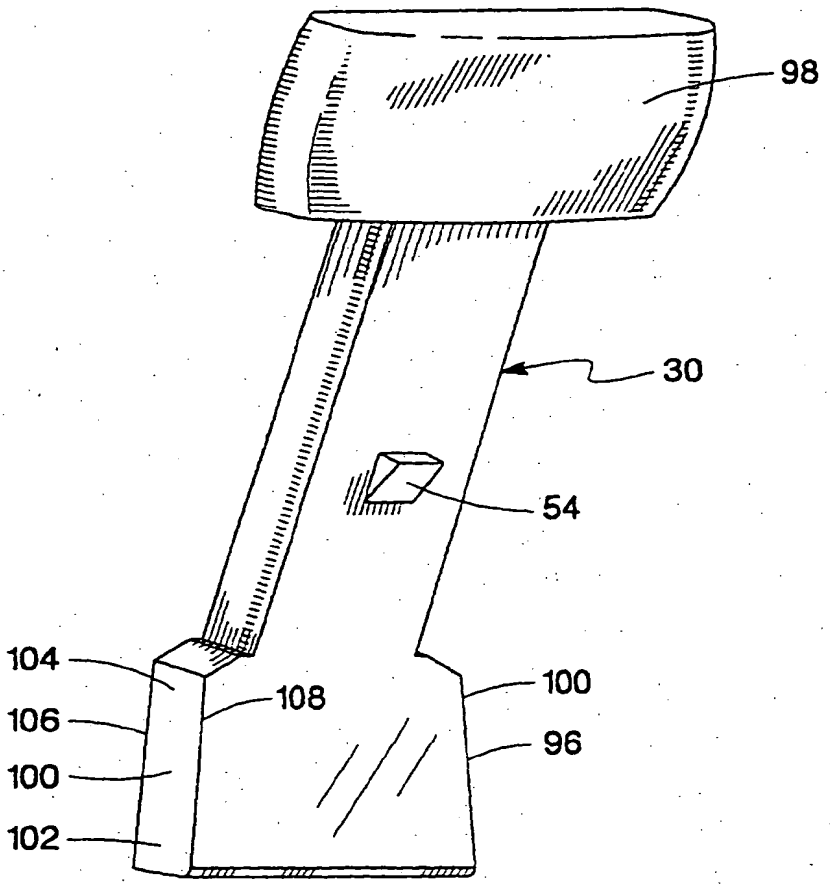

Fig. 12

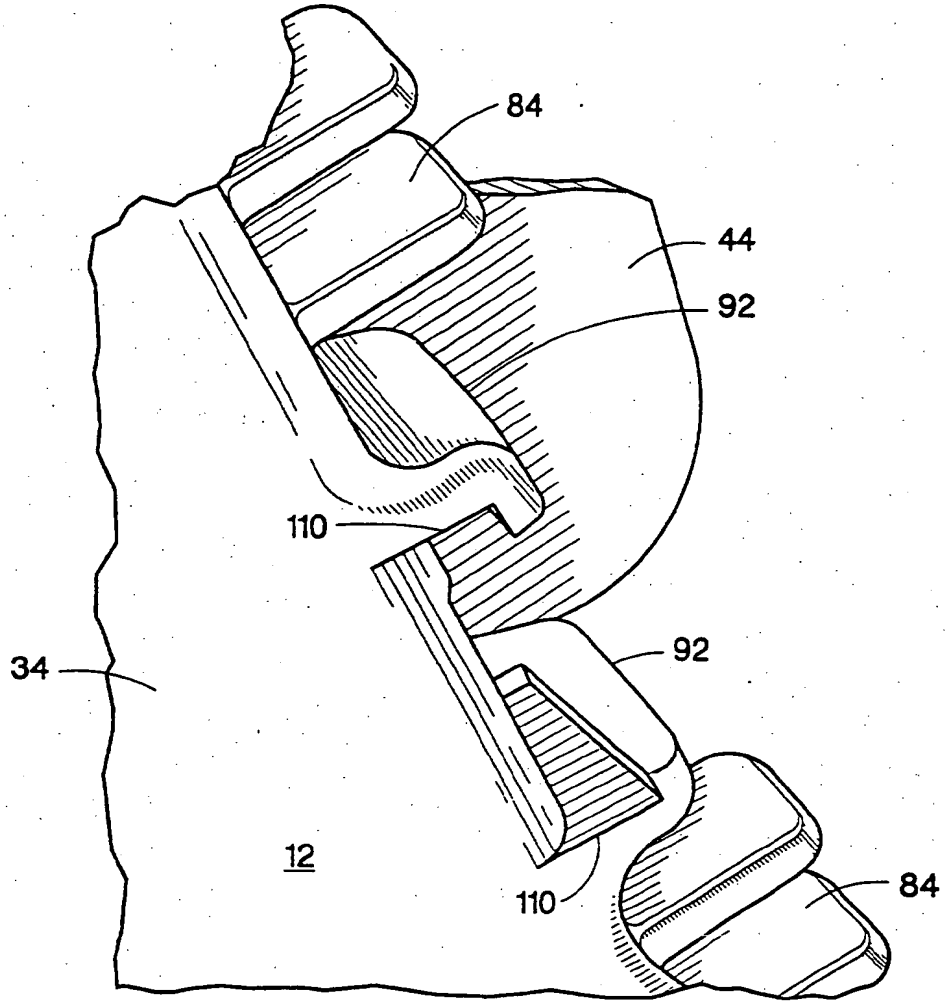

Fig. 13

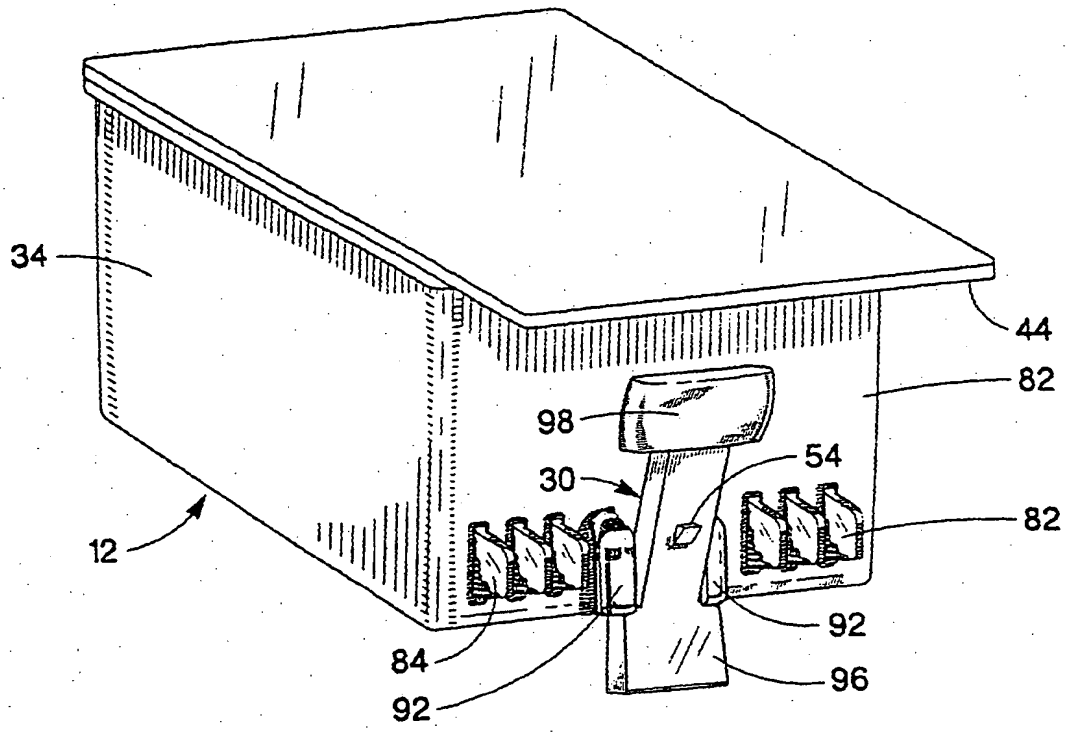

Fig. 14

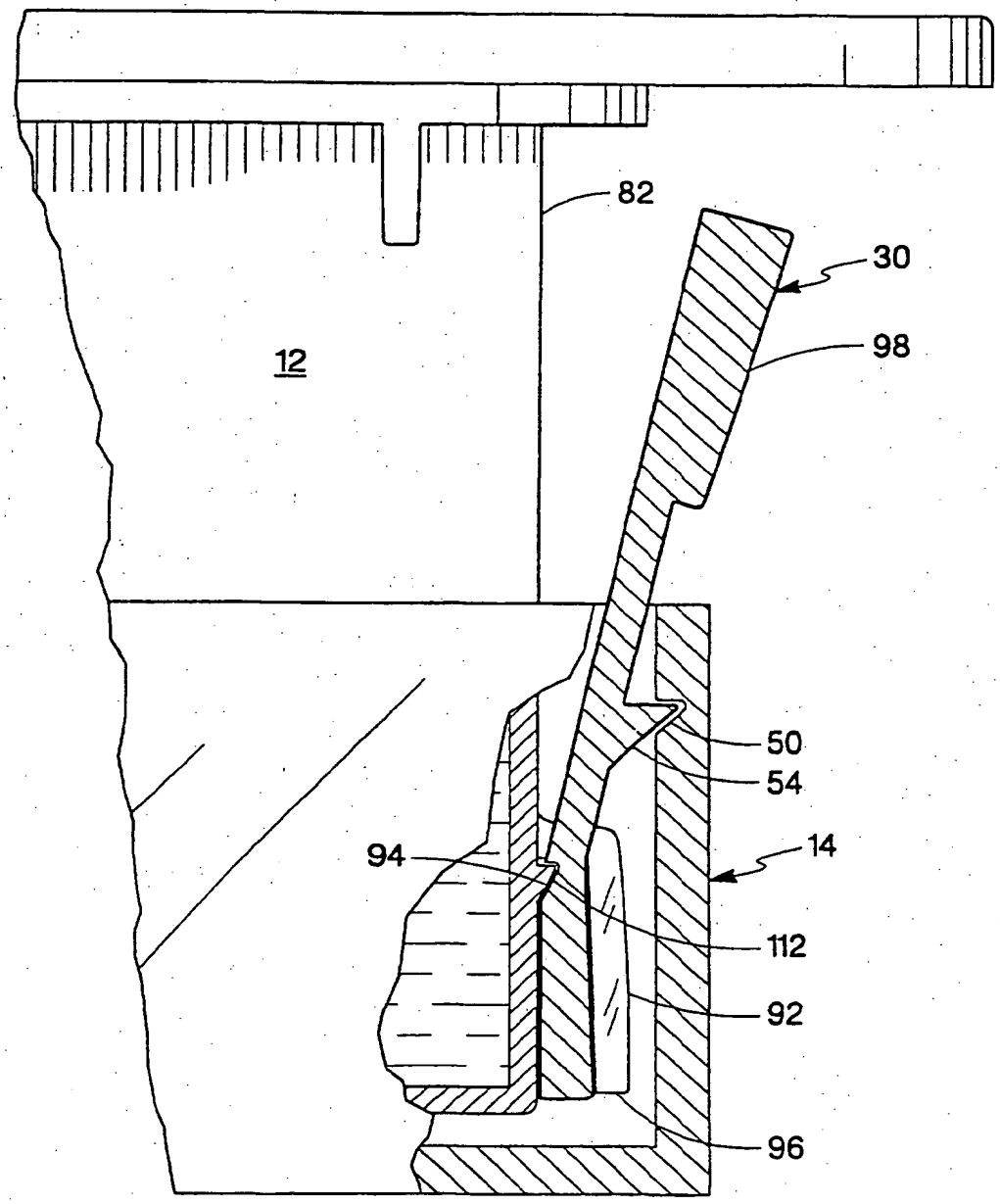

Fig. 15

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 30 0570

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 5 936 740 A (KANEKO YUICHI ET AL) 10 August 1999 (1999-08-10) * column 14, line 36-49; figure 17 *	1-11	B41J2/175
A	EP 0 822 084 A (CANON KK) 4 February 1998 (1998-02-04) * column 8, line 8 - column 9, line 13; figures 11,12 *	1-11	
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B41J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	14 May 2001	Kulhanek, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 30 0570

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